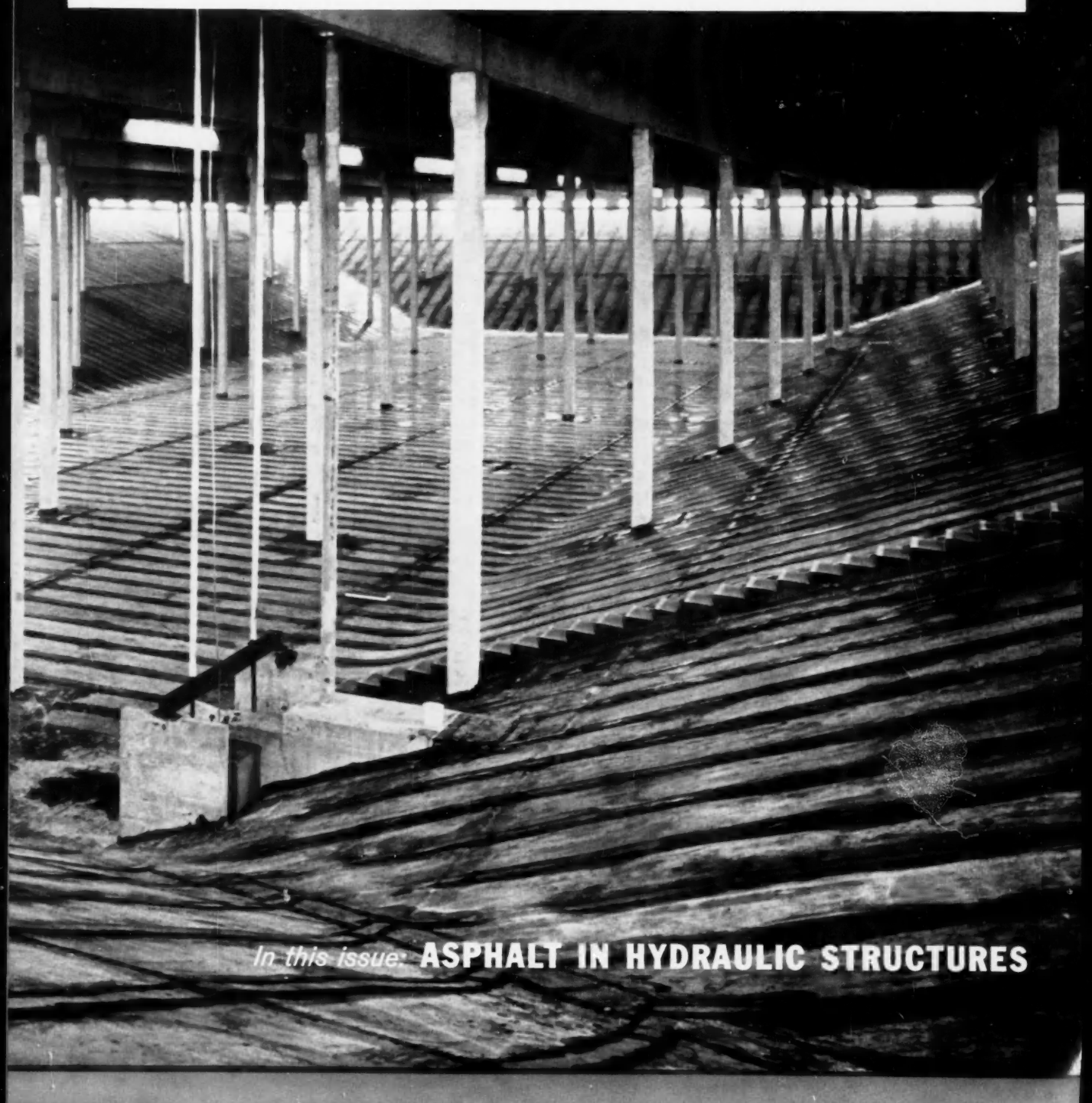
ASPHALT INSTITUTE *Quarterly*

JULY, 1961



In this issue: **ASPHALT IN HYDRAULIC STRUCTURES**

Annual Sales of Petroleum Asphalt and Road Oil to Domestic Consumers in U.S.A.

IN MILLIONS OF TONS

22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

1920 '21 '22 '23 '24 '25 '26 '27 '28 '29 '30 '31 '32 '33 '34 '35 '36 '37 '38 '39 '40 '41 '42 '43 '44 '45 '46 '47 '48 '49 '50 '51 '52 '53 '54 '55 '56 '57 '58 '59 '60*

NO OFFICIAL FIGURES AVAILABLE FOR PERIOD 1920-1930

*Unofficial Based on Preliminary Estimates

SOURCE: U. S. BUREAU OF MINES ANNUAL FIGURES
CHARTED BY THE ASPHALT INSTITUTE MAY 1961

TOTAL SALES	100%
PAVING	75%
ROOFING	16%
MISCELLANEOUS	9%

MISCELLANEOUS 9%
CHARTED BY THE ASPHALT INSTITUTE MAY 1961
*Unofficial Based on Preliminary Estimates

ASPHALTOPICS

ASPHALT INSTITUTE Quarterly

The versatility of our favorite engineering material never ceases to amaze. We've heard of asphalt being used to line the New York City garbage scows, and it's an uncensored fact that Britain used it in World War II as a "plastic armor" for her merchant ships to protect them from shell and bomb fragments. Now we learn that the deck of a cargo ship under construction at the Avondale Shipyard in New Orleans is being paved with four inches of low stability asphalt mix. The idea is to prevent the shifting of cargo in heavy weather. This sort of thing happens on steel decks, but the heavy cases and wheels tend to sink down comfortably in the low stability asphalt mix which anchors them in place 'til the long trick is over. A sister ship, the El Salvador, already is in service with asphalt decks and Owner J. E. Roberts of the Miami Terminal Transport Co. predicts that the day will come when all freighter decks will be paved with asphalt.

* * *

Our colleague, Ian S. Menzie, editor of the Shell Bitumen Review (Shell International), reports that the demand for the Shell reprint edition of the Asphalt Institute ***Quarterly*** *(distributed by Shell throughout its overseas marketing area) is in great demand. With a press run of some three thousand now, Shell decided to charge its associate companies a nominal fee to recover the reprinting costs. It was expected that the charge would result in a substantial drop in requests, but circulation fell by less than one hundred copies.*

* * *

When its mining economy played out, the little Colorado town of Lafayette just plumb refused to roll over and play dead. Within easy commuting distance of Boulder, Denver and Longmont, Lafayette changed from a coal mining town to a pretty commuters' suburb right at the back door to Estes National Park. And last year, this town with an eye on the future voted a $375,000 bond issue for a complete new set of city streets, 37 feet from curb to curb and paved with two inches of asphalt concrete on four inches of crushed aggregate base. The new street system offered such a striking pattern from the air that the Denver Post published an aerial view (see picture).

NEW INSTITUTE PUBLICATIONS

Soils Manual for Design of Asphalt Pavement Structures (Manual Series No. 10)—A comprehensive, richly-illustrated 240-page companion to other Institute manuals, dealing with soils evaluation and tests for design and construction of asphalt pavements. Includes procedures recommended by ASTM, AASHO and the U. S. Corps of Engineers.

Also, new edition of **Cost Reference Booklet** (Information Series No. 100)—A state-by-state examination of comparable paving projects which documents the construction economies to be realized with deep-strength asphalt design.

Vol. 13, No. 3 *July, 1961*

Glynn Harvey, *Editor*
Bill Weeks, *Associate Editor*

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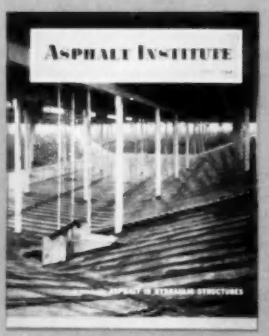
Cover

Asphalt was a popular engineering material 'way back when they were writing specifications with a mallet and chisel. Today it is enjoying a renaissance as a waterproof lining for canals and reservoirs—proving that history does repeat.



The Asphalt Institute Quarterly is published by The Asphalt Institute, an international nonprofit association sponsored by members of the petroleum asphalt industry to serve both users and producers of asphaltic materials through programs of engineering, research and education.

The member companies of the Institute, who have made possible the publication of this magazine, are listed on page 15.

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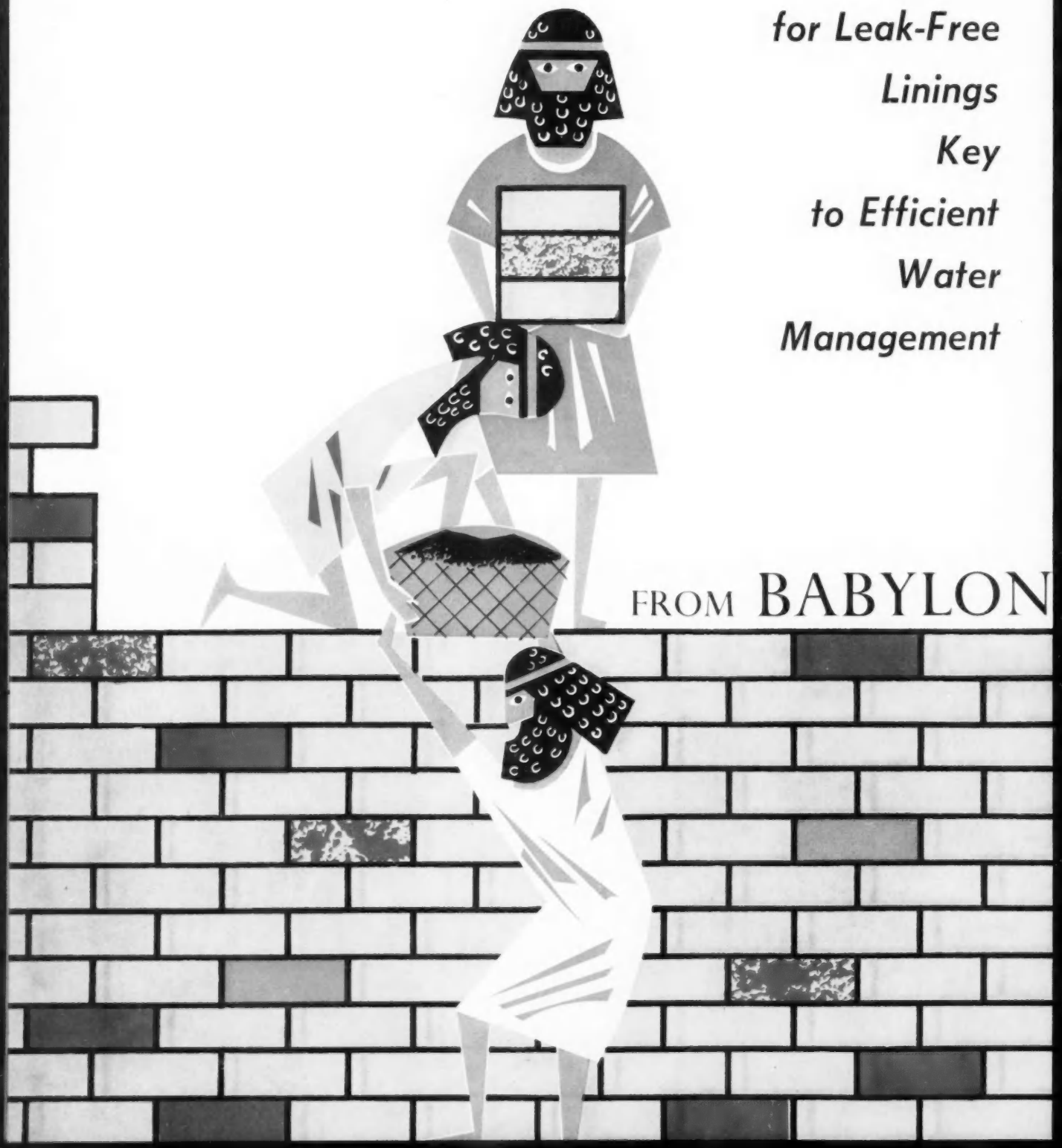
ASPHALT PANELS for Leak-Free Linings Key to Efficient Water Management



FROM BABYLON

Brine-resistant asphalt panels line this West Texas oil field sump

ONE of the more alarming aspects of the world population explosion is the fact that it appears to be accompanied by a steadily falling water table.

Here in the United States, a nation of prodigious water users and notorious water wasters, the imminent danger of a grave water shortage in many areas has both economists and sociologists concerned.

For this reason, the job of producing, transporting and storing water is no longer a fad, of limited interest only to a handful of wealthy planters in the semi-arid states. It's Big Business, and everybody's business. With more than one out of every four gallons of irrigation and drinking water being dribbled away in leakage and seepage, the need for more efficient handling of our water resources is apparent.

SHADES OF PTOLEMY

Interestingly enough, the engineers coping with this problem are finding the best solution in the use of one of civilization's oldest engineering materials. Back in the days of the pharoahs, bitumen—or asphalt, if you please—was freely used for lining and caulking hydraulic structures such as baths, pools and flumes. Today, a sophisticated, refinery-made cousin to that natural asphalt "pitch" is serving the same purpose in the lining of reservoirs for drinking water, irrigation canals and ponds, sewage lagoons, swimming pools, oil field sumps and a dozen other commercial installations.

In some instances, where large areas are involved, it's practical to place a hot, dense asphalt mix, using a modified version of a standard paving machine. In other circumstances, a popular application of bitumen as a lining or sealant is in the form of a semi-rigid "sandwich board," called an asphalt panel (or board, or sheet).

N TO BOISE

Taste-free and odor-free, asphalt panels are ideal for reservoirs

In its most common form, this panel consists of an inner core of a very dense mixture of asphalt cement and filler. The two outside layers are of some asphalt-impregnated material like tough asbestos felt or one of the fiberglass fabrics.

These panels—usually three or four feet wide and ten to twenty feet long—range in thickness from an eighth of an inch to a half-inch with the latter thickness in general use. Because of their semi-flexible character, asphalt panels can be made to conform to angles and slopes, and uneven subgrade. Yet, when properly supported, they are sturdy enough to withstand heavy erosion and the traffic of animals and light vehicles.

CAREFUL PLANNING NEEDED

Careful planning and workmanship are required for maximum efficiency. It's a good idea to lay out a scale drawing of the area to be lined, and then take great care in fitting and binding the joints.

Joints may be made either by butting or lapping, then bonding with hot asphalt adhesive or a cold asphalt mastic. Where panels are butted, the joint usually is covered with batten strip six to eight inches wide. The appearance of the lining is improved and its strength and impermeablity increased by applying by hand or towel, a fillet of mastic to the seam edges.

NO ODOR OR TASTE

The advantages of asphalt panel linings are numerous, not the least of which is the fact that they impart no odor or taste to the water—a significant virtue in lining storage basins for drinking water. Also, they are easily cleaned by scrubbing. The durability of these installations is proving out under toughest conditions, and accelerated weathering tests show that life, for an asphalt panel, begins at forty.

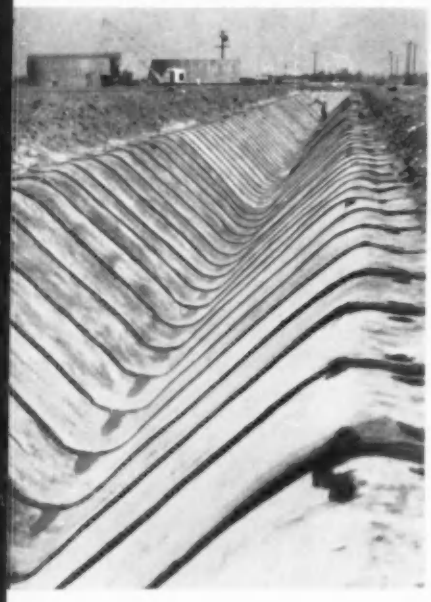
These prefabricated asphalt panels are particularly good for relining cracked and badly leaking linings of the rigid type. An excellent example is offered by the East Bay Municipal Utility District in Oakland, California, which, in 1955, called in Doctor Asphalt to save the life of the six-million-gallon San Pablo Clear Water Reservoir which was suffering from a severe case of the dribbles. Half-inch-thick panels were placed directly on the old rigid cover after being brought into the giant bowl through a small access door. The new asphalt lining controlled the leakage and is giving excellent service.

When the East Bay Municipal Utility District sets up its specifications for a reservoir lining project the requirement is that water leakage shall be restricted to a half a gallon per minute *for every one million gallons* in storage.

Asphalt panel linings not only have met this tough specification; they have bettered it in the recently constructed Maloney and Danville reservoirs!

Asphalt panels range in thickness from an eigth of an inch to a half-inch and are usually three or four feet wide and from ten to twenty feet long

Loss of valuable irrigation water by seepage and leakage is no problem in paneled ditches



Interstate Route 5 between Olympia and Ft. Lewis features asphalt curb

Curbing and gutters on mainline and ramp handle heavy rain efficiently

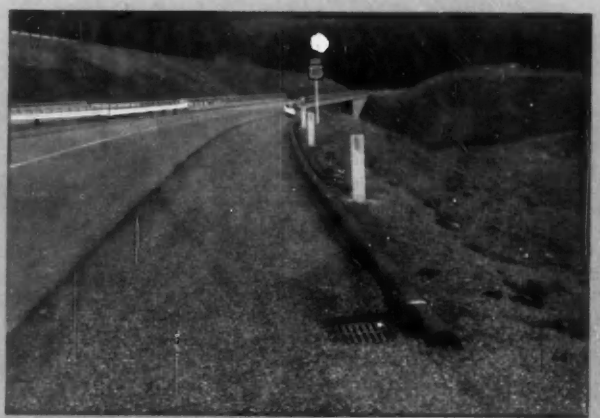
No Wash-Out in Washington

ASPHALT CURBS AND GUTTERS CHANNEL OFF SURFACE WATERS IN EVERGREEN STATE

PROPER drainage of both surface and sub-surface water is a form of life insurance for any pavement. The State of Washington scores high on both counts as these photographs show. Washington makes good use of asphalt-paved shoulders for added pavement support and to prevent the intrusion of surface water beneath the pavement surface. Asphalt curbs and flumes collect this running water and carry it off into suitable waste areas. This kind of attention to drainage, coupled with the asphalt-treated base construction and adequate compaction in all courses, is the key to sound asphalt pavement design.

Asphalt flume on ramp of U.S. Route 101 northbound from Olympia to Aberdeen

Asphalt curb on Interstate Five protects embankment from erosion, too



State of Washington designs in roads with a wary eye to drainage needs

First rough excavation for alley, showing curb construction

Picture made after rain dramatically illustrates alley drainage feature

The City of Odessa, Texas Builds DUAL-

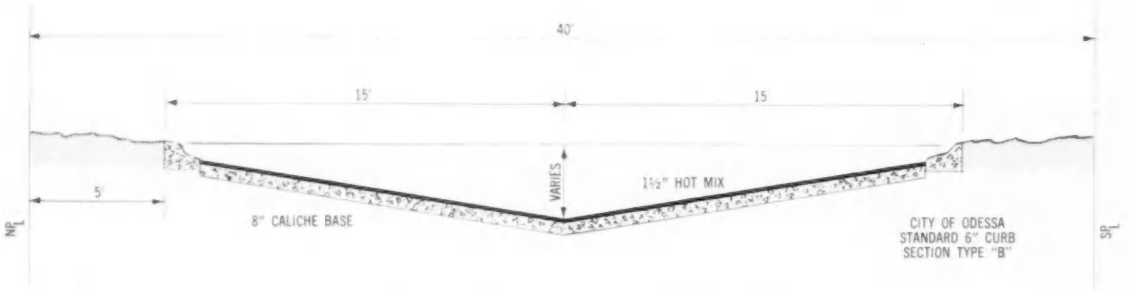


FIG. 1 TYPICAL ALLEY CROSS SECTION

By PAUL M. WEST
Director of Public Works
Odessa, Texas

Rounding out his sixth year with the City of Odessa, on the oil-drenched plains of West Texas, Paul M. West has served as Director of Public Works since 1959. An engineering graduate of Texas A & M in 1947, Mr. West served his engineering apprenticeship with the Houston district office of the Texas Highway Department, then worked with several consultants and contractors until he moved to Odessa.

THE City of Odessa, Texas, recently completed construction of an alley which will serve both as an access facility to commercial property and as a drainage channel. This alley drains an area in excess of three-hundred acres, as well as providing access to valuable commercial property fronting on one of our major thoroughfares.

The alley was built in conformance with Figure 1. Slopes of the invert varied from 10:1 to 5:1. Part of the excavation for this inverted alley was in rock and part in sandy soil. An eight-inch compacted caliche base was surfaced with one and one-half inches of hot mix, hot laid asphalt concrete. Hot mix asphalt concrete used in the alley is a dense graded mixture with 100% passing the one-half inch screen. Crushed limestone, screenings, and blow sand of the #80 and plus #200 variety were the aggregates. Natural mineral filler or minus 200 limestone dust in the screenings was reduced to four per cent in the final mix. Six per cent 120-150 penetration asphalt was used in the mixture.

Curbs were of 2,000-pound concrete of cross section as shown in Figure 2. This is a standard curb section used in all inverted streets in the City of Odessa. With one exception all standard size equipment used in the alley worked very effectively. A ten-ton tandem roller, on its initial pass over hot mix at the bridge wingwall tie-in points, 3 to 1 slopes, slipped

Only structure crossing the alley. Traffic lane to store entrance at right

Tanglewood Channel, shown here, serves to carry off surface water

PURPOSE ALLEY

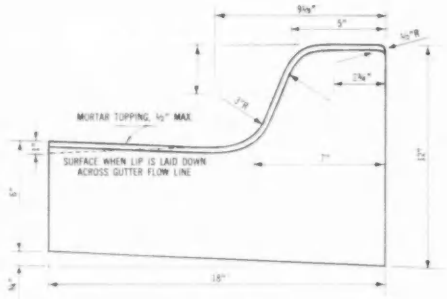


FIG. 2 STANDARD CURB SECTION

Intersecting streets, as shown in picture, are treated as dip sections

too much when starting and stopping and was promptly removed. Compaction was obtained at these points by vibrating screed of laydown machine, and twelve-ton self-propelled pneumatic rollers.

Although the alley property presents an unusual view, intersecting streets, treated as dip sections, add to the complete picture. The smooth-riding dips result from an all-out effort for the past several years to eliminate "neck busters", or outdated Model "T" dip construction. To produce riding quality and desired end results for all vehicular traffic and occupants crossing these and other necessary dips, we have introduced the following steps into construction:

1. At points fifty or sixty feet outside a proposed dip, we start losing street center line crowns in subgrade.

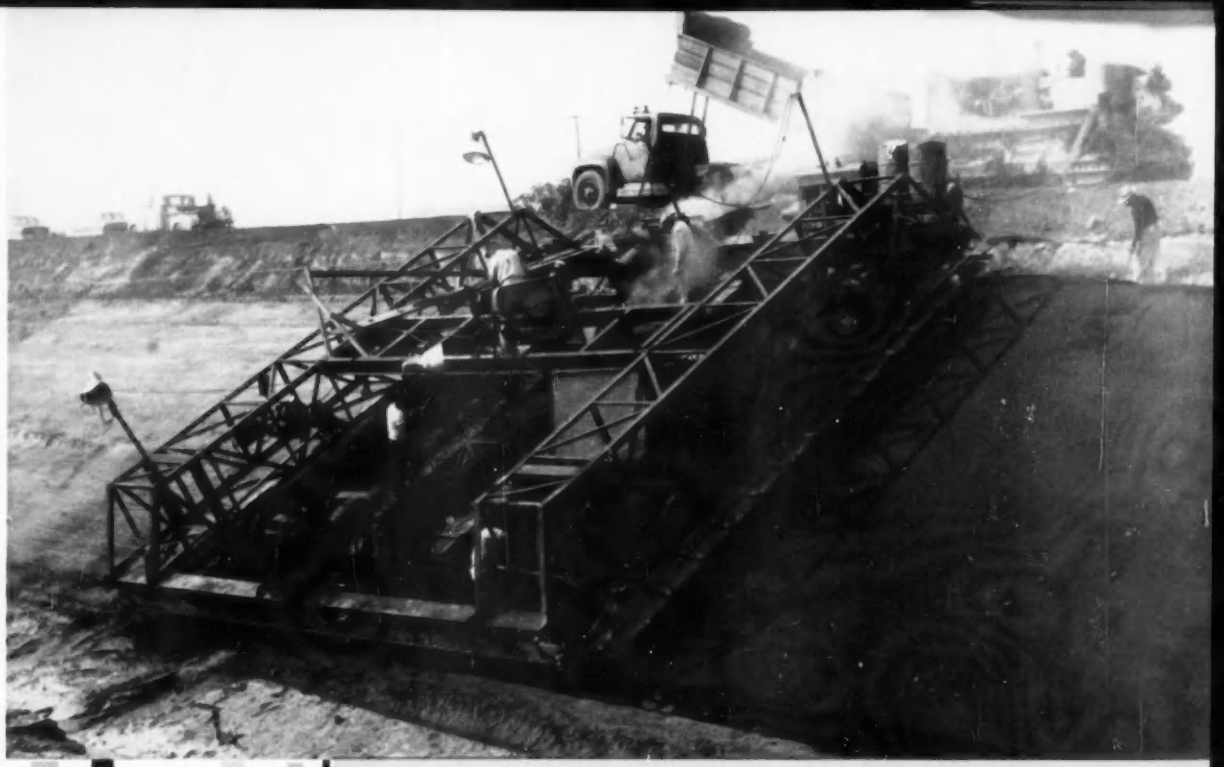
2. One dip across an intersection calls for a reduced intersection crown. For two dips, the intersection crown is reduced to a minimum.

3. In addition to setting blue tops, the processed base is test-driven in a pick-up truck traveling at speeds in excess of 30 miles per hour. This is necessary to prevent vehicle surge or rebound on a complete surface. Small-gauge nylon string, stretched from curb to curb, is used in conjunction with all phases of work.

By using these methods through construction, and allowing both long and short wheel base equipment to "float" in and out while processing various street materials, good riding quality is nearly an automatic result, and not only are these materials more efficiently processed, but the dips serve longer with less wear and tear on vehicles.

We have had very favorable reactions from the citizens of Odessa regarding this drainage facility. The City of Odessa feels that there is a definite use for inverted alleys and streets as drainage facilities. Our flat slopes, our soil conditions, and our climatic conditions all tend to make the use of inverted alleys and streets both desirable and economical. This inverted alley was designed to carry off a run-off of 300 cfs. All crossings except one are similar to the one shown in Figure 3. On one crossing a bridge was built to provide all-weather access to the area.

The City of Odessa has built, and has in use, several miles of inverted streets, all of which are penetration asphalt surfaces or asphaltic concrete. We have found no difference in the maintenance costs between inverted-crown streets and the normal-crown streets. Our plans for future drainage include the use of more inverted-crown streets as an integral part of our drainage facilities.



Paving machine built for 1955 project was adapted for new assignment

NOW LET IT RAIN

Los Angeles Flood Control District Paves Santa Ana River Revetment With ASPHALT

DESPITE the current dry cycle the Orange County Flood Control District of Southern California still has its weather eye cocked for future floods. And why not? That's their business.

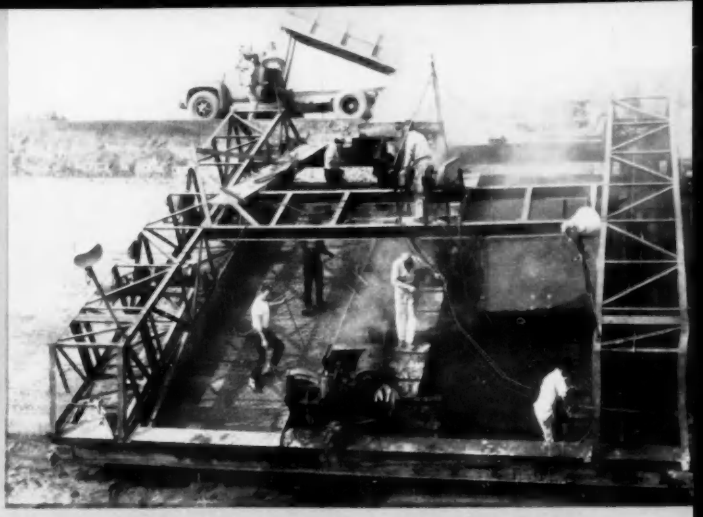
The Los Angeles County Flood Control District successfully slope-paved the revetments of the San Gabriel River in 1955. More recently, the Orange County Flood Control District chose asphalt as an economical means of paving the 2:1 bank slopes of the Santa Ana River.

Asphalt proved to be an economical choice for the 1,811,000 square feet of slope paving. Some 32,600 tons of asphalt mix were used. The successful bid of $770,425 revealed a calculated cost of 20 cents per square foot for the three-inch-thick wire-reinforced asphalt concrete surfacing.

Memories of the San Gabriel River project were revived when the contractor, Altfillisch Construction Company, of La Habra, resurrected the 60-foot-wide slope-paving machine he had constructed and used on that project in 1955. For Orange County's project, however, this same contractor rebuilt the machine by cutting it in half. One-half was used for a slope-paving machine and the other half was rebuilt to cut the sand subgrade and lay the Elwood-type fencing for wire mesh reinforcement simultaneously.

The primary purpose of the asphalt concrete facing was

Cutting sand subgrade and laying wire mesh reinforcement on revetment



Slope paving machine, fed by augur from truck on rim of the embankment

Asphalt concrete paving will protect sandy channel banks from washing

View of paved revetment, placed at a cost of 20 cents per square foot

to protect the very sandy channel banks from washing away in heavy rains and flood runoffs. To prevent underscouring, the toe of the revetment slope was over-excavated to a depth of four feet below the flow line of the channel, and asphalt paving was carried down to this depth. Backfill was subsequently brought back to flow line grade of the channel. The asphalt concrete surfacing was carried up to within four feet of the top of the revetment and then levelled off for a distance of 1′-2″ to prevent the entrance of rain water behind the paving. The length of the slope varied from 31.17 feet to 34.71 feet.

An asphalt cement content of eight percent of 85-100 penetration grade was used with the following gradation of aggregate:

SIEVE	% PASSING (BY WEIGHT)
No. 3	100
No. 10	65-80
No. 40	30-40
No. 100	14-22
No. 200	6-12

The mix was dumped from the haul trucks directly into the hopper of the self-propelled paving machine which fed it down the slope to the strike-off screed by means of an auger. Propulsion of the paving machine was affected by electric motors powered by towed motor-generator sets and winched to a dead man motor grader on the bank of the revetment. Where bridge crossings were encountered, the entire paving machine was lifted across by a crane. Adjacent to and under bridge areas the slopes were paved by hand with the use of 2 x 3 strike-off headers.

Initial rolling was accomplished by means of the rollers on the slope-paving machine which provided 80 pounds per lineal foot of compaction. Final rolling was done with single, weighted rolls winched up and down the slope.

Preparing and placing the wire reinforcement was a unique process developed by the contractor. At a central site five rolls of wire fencing were placed end-to-end on a power-driven roller. The rolls of wire were clipped together laterally by hand with wire staples as the fencing was rotated. Thus enough width of reinforcing was fastened together to cover the width of the slope to be paved. Wire reinforcement was placed longitudinally on the slope by the wire laying machine which was the reconstructed half of the paving machine used on the San Gabriel River project in 1955. The wire reinforcement was fastened down at the top of the paving four feet below the top of the revetment on the horizontal shelf by means of steel anchor pipes, 2¼ inches by five feet long, driven with a pneumatic hammer.

IN PORTLAND, OREGON

THEY JUST BUILT *another*

New Lloyd Center Shopping Center is Literally a City Within a City . . . .

City

IN THE belated rush to save the American city from extinction, the architects and planners are falling over each other with schemes boldly labeled "Urban Renewal" or "Urban Redevelopment."

In Portland, Oregon, the Lloyd Corporation and its bankers—the Prudential Insurance Company—decided to take a leaf out of the Koran. The mountain stoutly refused to come to Mahomet, so the Prophet went to the mountain. And the developers of the mammoth Lloyd Center solved the downtown Portland congestion problem by crossing the Willamette River and building a new city.

In every important respect, at least, Lloyd Center is quite literally a new city—or, at least, a city within a city. It includes some one hundred retail outlets, a 300-room Sheraton hotel, a medical center, entertainment, and acres of parking lots which can accommodate 8,000 cars.

The curse of midtown America today is the nerve-jangling scramble among pedestrians, motorists and truck drivers for elbow- and wheel-room. All this has been carefully sidestepped by the Lloyd Center planners who have provided

ample parking space for the motorist, traffic-free malls for the strolling shoppers, and underground concourses for the delivery trucks.

And this idyll of free and easy movement is neatly set off on some 150,000 square yards of asphalt concrete parking lots, ramps and concourses.

The second floor truck concourse consists of about 2,400 lineal feet of roadway 22 to 24 feet wide and the basement concourse consists of about 1,400 lineal feet of roadway. Parking areas embrace more than 27 acres—a total of approximately 1,200,000 square feet—of which about one third is under cover.

Parking areas at the Lloyd Center can accommodate 8,000 cars

Three parking levels, with mall level shown in the foreground

Delivery truck ramp, showing one of the unusual turntables

Second floor concourse represents 2,400 lineal feet of paving

Design of the asphalt pavement structure was the same for the parking areas and basement truck concourse. It consists of three inches of Oregon State Highway Department Class B mix (¾-inch minus) placed in two lifts over four inches of crushed rock base with conventional paving equipment.

The second floor truck concourse required a change in design and construction procedures. The design section called for three inches of Oregon State Highway Department Class C mix (one-half-inch-minus maximum size aggregate) with six percent of 85-100 penetration asphalt.

The mixture was placed over a waterproof membrane consisting of one ply waterproofing fabric between two plies of waterproofing felts. Gradation of the aggregate in the asphalt mix was as follows:

Percent of Aggregate	
½" to No. 4	28 to 40
No. 4 to No. 10	16 to 28
No. 10 to No. 40	16 to 28
No. 40 to No. 80	3 to 11
No. 80 to No. 200	2 to 8
Passing No. 200	3 to 7

The mix was transported in five-ton bob-tail trucks and only rubber-tired vehicles were allowed on the waterproof membrane. Spreading was done with a Bill's Extension Spreader which permitted spreading close to building walls and in areas of variable width.

The mix was placed in two lifts, with some difficulty being encountered when the heat of the asphalt mix caused the flood coat upon the waterproofing membrane to liquefy. As a result, the mix shoved excessively under early rolling and the crews had to wait until the mix had cooled considerably. On reflection, the contractors indicated they felt the substitution of an asphalt emulsion tack coat for the flood coat would have insured a proper bond and eliminated their principal construction problem.

Rolling was done with small tandem rollers and a vibrating one-ton Roll-pack or Vibro-Pac. Hand tamping was used in the more inaccessible areas.

Asphalt paving was done by two Portland sub-contractors —Cascade Construction Company and K. F. Jacobsen & Company.

THE ASPHALT INSTITUTE

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Asphalt Institute Building

College Park, Maryland

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(As of July 1, 1961)

The Asphalt Institute is an international, nonprofit association sponsored by members of the petroleum asphalt industry, to serve both users and producers of asphaltic materials through programs of engineering service, research and education. Membership is limited to refiners of asphalt from crude petroleum. Institute members provide quality products and advocate quality construction and timely maintenance.

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(As of July 1, 1961)

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NEW YORK 20, N.Y.—1270 Avenue of the Americas
New York City, Long Island and New Jersey

BOSTON 16, MASSACHUSETTS—419 Boylston Street
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont

ALBANY 7, NEW YORK—11 North Pearl Street
New York State (except New York City and Long Island)

HARRISBURG, PENNSYLVANIA—800 North Second Street
Delaware, Pennsylvania

RICHMOND 19, VIRGINIA—Travelers Building
Maryland, North Carolina, Virginia

ATLANTA 9, GEORGIA—881 Peachtree Street, N.E.
Florida, Georgia, South Carolina

MONTGOMERY 4, ALABAMA—79 Commerce Street
Alabama, Tennessee

NEW ORLEANS 18, LOUISIANA—Maison Blanche Building
Louisiana, Mississippi

DIVISION II—OHIO VALLEY-GREAT LAKES

COLUMBUS 15, OHIO—Neil House
Indiana, Kentucky, Michigan, Ohio, West Virginia

LANSING 16, MICHIGAN—109 West Michigan Avenue
Indiana, Michigan

LOUISVILLE 7, KENTUCKY—4050 Westport Road
Kentucky, West Virginia

DIVISION III—MIDWEST

ST. PAUL 4, MINNESOTA—1951 University Ave.
Colorado, Idaho, Illinois, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota, Utah, Wisconsin, Wyoming

PIERRE, SOUTH DAKOTA—104 South Euclid
North Dakota, South Dakota

CHICAGO 39, ILLINOIS—6261 West Grand Avenue
Wisconsin, Metropolitan Chicago

SPRINGFIELD, ILLINOIS—2606½ South Sixth Street
Illinois (except Chicago), St. Louis County, Missouri

KANSAS CITY, KANSAS—2500 Johnson Drive, Shawnee Mission P.O.
Kansas, Missouri (except St. Louis Co.), Nebraska

DENVER 2, COLORADO—1031 15th Street
Colorado, Utah, Wyoming

HELENA, MONTANA—Power Block
Idaho, Montana

DIVISION IV—SOUTHWEST

DALLAS 6, TEXAS—Meadows Building
Arkansas, New Mexico, Oklahoma, Texas

AUSTIN 1, TEXAS—Perry-Brooks Building
Texas

OKLAHOMA CITY 2, OKLAHOMA—Republic Building
Arkansas, Oklahoma

SANTA FE, NEW MEXICO—10 Radio Plaza
New Mexico, Western Texas

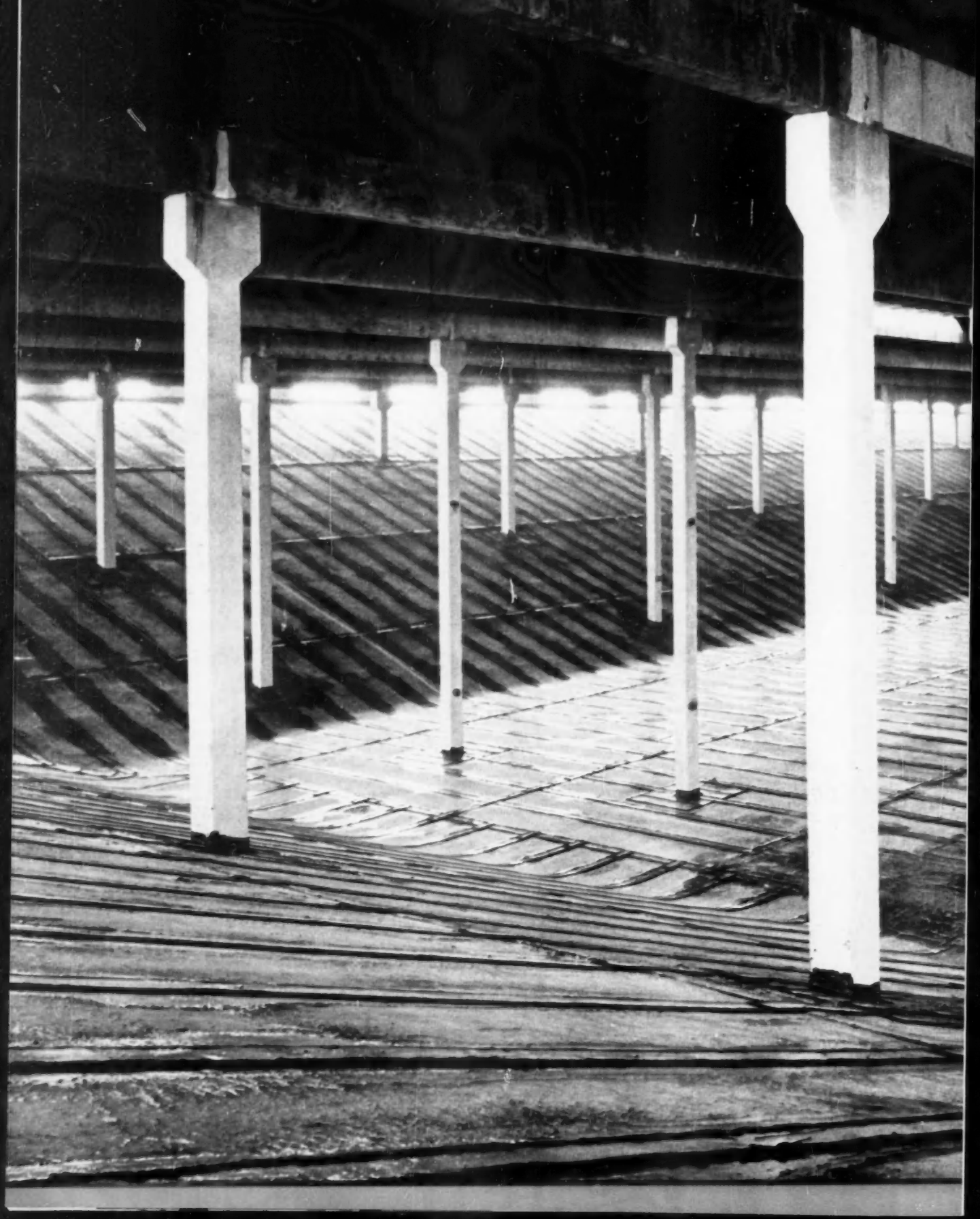
DIVISION V—PACIFIC COAST

BERKELEY 10, CALIFORNIA—810 University Ave.
Alaska, Arizona, California, Hawaii, Nevada, Oregon, Washington

LOS ANGELES 17, CALIFORNIA—1709 West 8th St.
Arizona, Southern California

SACRAMENTO 14, CALIFORNIA—Forum Building
Central and Northern California, Nevada

PORTLAND 1, OREGON—2035 S.W. 58th Avenue
Oregon

OLYMPIA, WASHINGTON—National Bank of Commerce Building
Alaska, Washington

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